COOLING SYSTEM WITH REFRIGERANT FOR AIR CONDITIONING AND LOWERING TEMPERATURE OF ENGINE

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates to a cooling system for a car engine system/device, and particularly to a cooling system/device, in which an ordinary car room air conditioning system with refrigerant, a compressor, heat dissipating fins and pipeline for circulating the refrigerant is utilized and expanded to provide a function of engine system cooling in addition to the car room air conditioning.

2. Description of Related Art:

The conventional car room air conditioning system, which includes refrigerant, a compressor, heat dissipating fins and pipeline for circulating the refrigerant, usually only provides a function of cooling car room space and not for cooling the engine system. On the other hand, the engine system generally is cooled by way of water circulation of the water box system passing through the engine body (water cooling type) or part of outside air being guided to the engine blowing the dissipating fins surrounding the engine (air cooling type) with the aid of oil circulation for heat dissipation.

These traditional cooling systems for engine are designed to meet ordinary air temperature condition and driving requirement so that it is incapable of treating abnormally high air temperature situation and/or long period of engine running fiercely. It is very likely to result in excessively high engine system temperature and lead to engine parts being out of order and/or short life span. The cooling system of the present invention allows the engine system sharing part of the air conditioning capability (usually being surplus) such that the engine system can be cooled

sufficiently So as to enhance work efficiency thereof and prolong life span of the parts therein.

SUMMARY OF THE INVENTION

The crux of the present invention is to utilize the high temperature deduction capability obtained with the refrigerant type cooling system of car room air conditioning, in which a connecting pipe between the evaporator in the low pressure stage of the refrigerant type cooling system and a dehumidifying water collector at the middle section thereof is arranged to guide the refrigerant into a heat exchanger and the refrigerant passes through a refrigerant passage in the heat exchanger before flowing back to another connecting pipe between next evaporator section and dehumidifying water collector. One of embodiments in accordance with the present invention provides that heat exchanger covers a section of the intake pipe in front of the throttle valve and the engine intake pipe has a greater area contacting with pipe wall of the refrigerant passage.

Another embodiment of the present invention provides that the intake pipe covered by the heat exchanger is replaced with the oil pipeline and the oil pipeline in the heat exchanger has smaller pipe diameter with a roundabout way so as to extend the length thereof in the heat exchanger as long as possible for increasing contact area with the refrigerant passage. Hence, the cooling system of the present invention can cool the intake air and/or the oil of the engine in addition to the car room air conditioning. As a result, it is capable of enhancing the engine efficiency, lowering chance of malfunction for the engine and prolonging lifetime thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention can be more fully understood by reference to the following description and accompanying drawings, in which:

Fig. 1 is a plan view of pipeline illustrating a first embodiment of the present invention applied to cooling air intake of an engine;

Fig. 2 is a plan view of pipeline illustrating a second embodiment of the present invention applied to cooling air intake of an engine sectional view of the pivotal shaft assembly shown in Fig. 1;

Fig. 3 is a plan view of pipeline illustrating a third embodiment of the present invention applied to cooling air intake of an engine perspective view of another embodiment according to the present invention;

Fig. 4a is a plan view illustrating an embodiment of the present invention applied to cooling engine oil;

Fig. 4b is a plan view illustrating a further embodiment of the present invention applied to cooling engine oil; and

Fig. 5 is a plan view illustrating a water spray cooling apparatus.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to Fig. 1, a cooling system with refrigerant according to the present invention includes a compressor 1, a pulley 2, a condenser 4, a connecting pipe 3, which is disposed between the compressor 1 and the condenser 4, a fan 5 for the condenser 4, an expansion valve 7, an evaporator 8, a connecting pipe 6, which is disposed between the condenser and the evaporator 8, a cold air fan 9, a dehumidifying water collector 11, a connecting pipe 10, which is disposed between the evaporator and the dehumidifying water collector and a connecting pipe 12, which is disposed between the dehumidifying water collector and the compressor. The preceding components are basic elements required for constituting a car room of an air conditioning system. The route from the compressor 1 and the connecting pipe 3 to the expansion valve 7 via the condenser 4 is a high pressure stage and the route

after the expansion valve 7 to the connecting pipe 12 via the evaporator 8 is a low pressure stage.

The entire circulation cycle includes the high pressure stage and the low pressure stage and is filled with the refrigerant. The refrigerant is in a state of liquid at the high pressure stage and in a state of gas at the low pressure stage. The compressor 1 compresses the refrigerant coming from the low pressure stage and sends the pressurized refrigerant to the high pressure stage. The expansion valve 7 admits the pressurized refrigerant to flow toward the low pressure stage only if the pressure in the high pressure stage exceeds the pressure in the low pressure stage a preset pressure difference. The preset pressure difference can secure the refrigerant in the high pressure stage with a high pressure being capable of being liquefied and the refrigerant in the low pressure stage with a low pressure being gasified under a normal condition with which appropriate amount of refrigerant is filled in the cycle and the ambient temperature is in a normal range. Of course, the refrigerant in the high pressure stage may keep in a state of gas due to high temperature without cooling aids of the condenser 4 and the condenser fan 5 in spite of being high pressure. On the other hand, the refrigerant in the low pressure stage may keep in a state of liquid due to low temperature without heat collection aids of the evaporator 8 and the cold air fan 9 in spite of being low pressure.

The gaseous refrigerant from the low pressure stage is compressed with the compressor 1 and sent to the high pressure stage as liquid refrigerant such that the temperature of the refrigerant rises under high pressure because of heat absorbing previously and the heat can be dissipated effectively to outside with aids of the condenser 4, which is provided with large cooling area, and the condenser fan 5. Then, the refrigerant passes through the expansion valve 7 and enters the low pressure stage with lower heat. The refrigerant entering the low pressure stage decreases the pressure thereof largely in company with lowering the temperature

thereof largely. The relationship of the pressure and the temperature can be expresses with the equation of ideal gas, PV=nRT, wherein, P is designated as pressure value, V is designated as volume of a container, n is designated as number of gas molecules, R is designated as a constant and T is designated as absolute temperature.

The evaporator fan 9 blows the air coming from the car room or outdoors toward the evaporator 6 and finally to the car room as cold air via air conditioning pipeline and air outlet. As the foregoing, the refrigerant entering the low pressure stage has lowered the temperature thereof greatly and, in fact, the temperature thereof can drop below 0°C. In case of an older type of car air conditioning system (without microcomputer constant temperature control) for being used, the air outgoing pipeline may be blocked due to occurring freeze to result in outgoing air flow being less gradually till no air flow coming out if little air flow being blown out. Under this circumference, if the fan is turned up to the maximum capacity and it is switched to the mode of guiding in outside air, the temperature of the outside air is higher so as to melt the frozen pipeline and to restore the original air flow. However, the cold air becomes colder with vapor. This phenomenon proves temperature of the refrigerant in the low pressure stage can drop down below 0°C.

The highly efficient temperature reduction capability of the refrigerant type cooling system is utilized in the present invention so that a cooling block A of an engine system is introduced in the connecting pipe 10, which is between the evaporator and dehumidified water collector in the low pressure stage. The cooling block A in the first embodiment includes a heat exchanger 20 surrounding a section of the intake pipe 21 at the front side of a throttle valve 213 (counted with intake air sequence) in the engine. The heat exchanger 20 includes a refrigerant inlet 221, a r-frigerant outlet 222 and an internal refrigerant passage 22, which provides a greater area contacting with a section of intake pipe 21 in the heat exchanger 20. The

refrigerant passes through the evaporator 8 to enter the refrigerant passage 22 via the connecting pipe 10 and the refrigerant inlet 221 and then flows out the heat exchanger 20 via the refrigerant outlet 222. The engine intake air flows into a section of the intake pipe 21 via the air inlet 211 and then flows out the exchanger 20 via the air outlet 212 before reaching the throttle valve 213.

Because the engine intake air has been cooled down highly efficiently during passing through the heat exchanger 20 before entering the engine cylinder, the first embodiment of the present invention at least has the following effects: first, the gross heat of the intake air is decreased during entering the engine and it represses the engine to generate heat to a certain extent, that is, it reduces the temperature; next, due to air entering the engine having lower temperature and the engine intake pressure and the cylinder volume being unchanged, the number of gas molecules entering the engine increases according to the equation of ideal gas PV=nRT such that mixture of fuel and air in the cylinder can provide greater explosive power to enhance torque and horsepower or to save more fuel. The second effect is the same function as a light super charger mounted in a car and the air intake in the engine can increase accordingly. If an intermediate cooler do not equipped in the engine, temperature of the engine rises up during running regardless the super charger is turbine type or mechanical type. The cooling system for the engine intake air in the first embodiment of the present invention not only can increase the air intake but also can lower the engine temperature.

The embodiment shown in Fig. 1 illustrates the path of the refrigerant flowing to the dehumidified water collector 11 from the evaporator 8 requires to pass through the cooling block A in the engine system. In fact, the entire refrigerant cycle can be designed as a cycle shown in Fig. 2. It can be seen that there are parallel connecting pipes 10, 10'between the evaporator 8 and the dehumidifying water collector 11. The connecting pipe 10' communicates with the evaporator 8 and the dehumidifying water

collector 11 and the connecting pipe 10 at the middle section thereof is inserted with a cooling block A in the engine system such that the refrigerant, which flows to the dehumidifying water collector 11 from the evaporator 8 via the connecting pipe 10, has to passes through the cooling block A and performs cooling of the engine system.

The connecting pipe 10 provides a valve 101 at least at an end thereof. Once the refrigerant cooling system is started by the user, the car room air conditioning can be performed regardless the cooling function of the engine system is effected or not. The cooling function of the engine system depends on if the valve 101 being opened or closed. In case of the valve 101 being opened, the refrigerant can pass through the connecting pipe 10 and the cooling block A to result in cooling function of the engine system. In case of the valve 101 being closed, the refrigerant stops passing through the connecting pipe 10 and the cooling block A such that it is not possible to provide the cooling function of the engine system. Even if the valve 101 has been opened and the engine system has performed the function of cooling the engine system in the embodiment, part of the refrigerant flows to the dehumidifying water collector 11 directly from the evaporator 8 via the connecting pipe 10. In order to allow the cooling function of the engine system being performed more effectively, a three-way single choice valve 102 can be mounted at a junction of the connecting pipe 10' and the connecting pipe 10 as shown in Fig. 3 instead of the valve 101, which only can be operated with the opening and the closing states. This design allows the user to select a way that the refrigerant only flows along the cooling block A of the engine system and provides a better cooling function for the engine system than the previous design or select another way that the refrigerant only passes through the connecting pipe 10' directly for stopping the cooling function of the engine system.

The cooling block A of the cooling system with refrigerant according to the present invention can be used for cooling turbine super charging engine or mechanical charging engine in addition to using for natural air intake engine. The

cooling block A can be joined to the intermediate cooler frequently utilized by the super charging system and is positioned closer the throttle valve 213 than the intermediate cooler. The cooling system with refrigerant according to the present invention can lower air temperature in the intake pipe 21 below the ambient temperature. The conventional intermediate cooler is only possible to lower air temperature in the intake pipe 21 closer to the ambient temperature. Alternatively, the cooling block A of the cooling system with refrigerant according to the present invention can be used instead of the intermediate cooler frequently utilized by the super charging engine, which is responsible for lowering the temperature of the intake air. The intake air is often pressurized to occur temperature rise, and the effect is much better than the intermediate cooler.

Further, the cooling block A of the cooling system with refrigerant according to the present invention can be used for cooling engine oil in addition to being used for cooling natural air intake engine or intake air of the super charging engine. Referring to Figs. 4a and 4b, the cooling block A of the engine system for cooling engine oil is processed by that the refrigerant enters the connecting pipe 10 between the evaporator at the low pressure stage and the dehumidifying water collector and flows and finally flows out of the heat exchanger 20 to the refrigerant passage 22 in the heat exchanger 20 via the refrigerant inlet 221 to flow back to next section of the connecting pipe 10 between the evaporator and the dehumidifying water collector. The embodiment being different from the cooling system shown in Figs. 1 to 3 is in that the engine intake pipe 21 included in the heat exchanger 20 contacting with refrigerant passage 22 as shown in Figs. 1 to 3 and an oil passage 21 included in the heat exchanger 20 contacting with the refrigerant passage 22 as shown in Fig. 4. The engine oil enters the engine oil passage 21 in the heat exchanger 20 via the oil inlet 211 and flows out of the heat exchanger via the oil outlet 212 toward the next section of the oil circulation cycle.

Because temperature of the oil is pretty high during the engine running and the temperature much higher than that of the engine intake air, the oil passage 21 in the heat exchanger 20 is provided with a smaller cross section or a smaller passage diameter and with a circuitous way so as to extend the length of the oil in the heat exchanger 20 as longer as possible and increase contact area of the oil passage 21 with the refrigerant passage 22 as shown in Fig. 4a. Another way for increasing the contact area is to provide a plurality of parallel oil passages with smaller cross sections or smaller passage diameters connecting with the oil inlet 211 and the oil outlet 212 as shown in Fig. 4a. The cooling system with refrigerant according to the present invention is capable of effectively lowering the temperature of the oil in the engine quickly such that it is possible to avoid malfunction and/or to prolong parts in the cooling system.

When the cooling system with refrigerant according to the present invention is applied to cool the engine oil, the refrigerant circuit outside the heat exchanger 20 can be arranged as that illustrated in Figs. 1 to 3 in which the through connecting pipe 10', the valve 101 and the switch valve 102 can be included or excluded.

The cooling system with refrigerant according to the present invention can be attached with a water spray cooling device to cool each high temperature component in the engine chamber including the engine itself during the car running. Referring to Fig. 5, the water spray device 50 includes a water trough 51, a water deliver pipeline 52, a water pump 53 and a spray nozzle 54. The spray nozzle 54 is provided with small outgoing apertures for keeping water pressure so as to spray very fine water columns or mist columns with a shape of approximate straight lines. The spray nozzle 54 can be mounted in front of a heat dissipating water box of the water cooling type engine or a heat dissipating fins of the air cooling type engine to face the water box or the fins. Once the car is moving, the air at the front side entering the engine is helpful for the water columns reaching the engine and other high temperature parts in the

engine. The water spray nozzle 54 can mounted in front of the heat dissipating fins for oil and face the heat dissipating fins for oil to cool the oil. Alternatively, the water spray device includes two water nozzles 54 to face the heat dissipating water box and the heat dissipating fins for oil respectively.

The water trough 51 can be set up independently or the heat dissipating water box in the water cooling type engine can be used as the water trough 51. The water pump 53 connects with a logic control unit 55 so that the water pump 53 can run or stop running depend on instructions of the logic control unit 55. The logic control unit 55 continuously receives a serious of signals from a temperature sensor 56 and the signals represent temperature values. The temperature values are compared constantly with preset temperature values under specific actuation conditions by the logic control unit 55 and then the water pump 53 is ordered to actuate an action of pressing water such that the pressed water can sprinkle via the nozzle 54. The temperature sensor 56 can be mounted to contact with the water box, the engine or the heat dissipating fins for oil to pick the data of temperatures there. The preset temperature values under specific actuation conditions in the logic control unit 55 can be assigned in the factory or can be obtained by way of an actuation temperature adjuster 57 such as a turning knob or a plurality of buttons being connected to the logic control unit 55. The temperature adjuster 57 also can include a device of temperature scale, digital display or analog display of temperature.

The user can adjust the preset actuation temperature to a little higher an average temperature of the water box, the oil or the engine under normal driving condition such that the logic control unit 55 can order the water pump 53 to press water out via the nozzle 54 once the detected temperature is higher than the preset actuation temperature and most mechanical parts in the engine room can reduce the temperature quickly. The nozzle can stop spraying the water once the detected temperature drops below the preset actuation temperature. Hence, the engine system

of a car can keep a constant temperature during running.

While the invention has been described with reference to the preferred embodiments thereof, it is to be understood that modifications or variations may be easily made without departing from the spirit of this invention, which is defined by the appended claims.